the nerve-annoying tremors incident to the usual reciprocating engines, the *Virginian* has proved far and away the quietest steamship I have ever voyaged on. Excellent evidence of this, I think, lies in the exceptionally large number of passengers who dined comfortably in the saloon at the roughest period of our entire passage. There was a fairly heavy sea on, and the ship was by no means free from wave-origined motion. So I am quite of the opinion that sea-sickness and all its train of discomforts must be greatly aggravated by the engine-borne tremors of the ordinary steamship, and that many people who are delicate sailors under ordinary conditions might take ocean journeys with comparative comfort in a turbined ship.

So unostentatious are the rotary engines of the *Virginian,* let alone their occupying but one-fourth the space of the usual expansion engines, that the quietness of their powerful and effective working, in every part of the ship, was continually deceiving one into thinking that the vessel had lost headway, or might have come to anchor altogether. Especially was this true in the dining saloon, that most critical of all spots, where one could rarely detect so much as a ripple on water in a glass, although going ahead at full speed of 15 knots.

To my mind the *Virginian* seemed to behave all the voyage quite as if her motive power were entirely without her; in fact, she could scarcely have ridden more smoothly, or with less of that exasperating vibration (the unceasing action of which, I am convinced, is a prominent factor in inducing *mal de mer*), if she had been towed at the identical speed by a huge hawser. DAVID TODD.

R.M.S. *Virginian,* Straits of Belle Isle, October 4.

A Parasite of the House-fly.

REVERTING to the recent correspondence under this heading between Mr. Davenport Hill and Prof. Hickson (NATURE, August 24 and 31), I recall that a few years back many house-flies with Chelifers attached were sent to me at the Natural History Museum for determination of the species and explanation of the phenomenon. The first task was as easy as the second was difficult. The Chelifer was in most, nay in all, cases, so far as my memory serves, *Chernes nodosus.* But those who suggest that the explanation is to be sought and found in the value of the habit as a means of securing dispersal hardly realise, I think, the difficulties in the way of its acceptance. Chelifers are minute, active, and, for arthropods, not exceptionally prolific. Hence the sufficiency of "elbow-room" for the survivors of a family of, say, forty, on the site chosen by the female for her progeny does not coincide with the view that they have special need of transportation. Moreover, when we remember that a Chelifer attached to a fly is exposed to the danger of being killed by the enemies of that insect, and also to the great chance of being landed in a wholly unsuitable environment, it can hardly be maintained that the advantage derived from this method of dispersal has been a sufficiently important factor in survival to preserve and foster an initial instinct to grab and hang on to the legs of flies. That the aërial porterage thus secured, whether fortuitously or "intentionally," must be a means of dispersal is too obvious to dispute; but I do not think more than that can be claimed for it, since it is as likely to end in failure as in success.

Chelifers may be found not uncommonly beneath the wing-cases of large beetles. Presumably this habitat has been adopted for the sake of the food supplied by the parasitic mites infesting the beetles. This fact, I think, suggests a line of investigation which may lead to a more satisfactory explanation of the association between Chelifers and flies than that put forward in Prof. Hickson's letter.

Zoological Gardens, October 14. R. I. POCOCK.

Incandescence of Meteors.

IT is with great diffidence that I approach this difficult subject, but the theory that the incandescence of meteors is due to the heat generated by the friction between these bodies and the molecules of gas composing our atmosphere I have always found difficult to believe. The following theory is one which has occurred to me, and seems quite a plausible one. Meteors are usually of a metalliferous nature, and consequently will have a comparatively low electrical resistance. When they approach the earth they will enter a magnetic field, and they will cut the lines of force of this field at a high velocity. A high electrical potential will be generated, and consequently electric currents which will be inversely proportional to the resistance. The electrical energy thus produced will be dissipated in heat, and if of sufficient intensity will raise the meteor to incandescence. The truth or otherwise of this theory could, I believe, be calculated, as the data necessary for doing so will be at the disposal of readers of NATURE who make this branch of astronomy their study. This theory may have already been advanced, as I am not in touch with the latest developments of the science.

Coatbridge, September 5. GEORGE A. BROWN.

THE electric currents which the author of the above letter regards as possibly constituting an efficient source of the luminosity of meteors must no doubt arise, and play a certain part in the heat and light development. But the measure in which they can be supposed to contribute to it must clearly be extremely small; or rather, it must be incomparably subordinate to the intense ignition of the air produced, not at all by friction,[1] but by the air's adiabatic compression against the front surface of the meteorite; which is certainly quite competent, by itself alone, to develop what may be said to approach pretty nearly to fabulous degrees of temperature. If the kinetic energy of translation, in foot-pounds ($v^2/2g$), of 1 lb. of the air propelled (at, say, 30 miles per second) with the meteor's speed (v feet/sec.) on its front face, be divided by 330, the number thus obtained (1,180,620° C., in the case supposed) will be the number of centigrade degrees through which it will be heated by the pure process of compression, supposing that the air can continue to subsist at all with its ordinary mechanical deportment and thermodynamical properties unaffected at that enormously high temperature. In the further forward, gradually advancing layers, and in the laterally escaping currents of the air, on which the high forward speed of the meteor is only partially impressed, and which move more slowly on their various courses, the compressions are correspondingly less, and the lower but still exceedingly high temperatures can be similarly calculated from any fair estimates of the air's collective or absolute velocity of translation in those different positions.

It is in the different rates of transport of these heated air-streams, all of them, as well as the highly attenuated motionless atmosphere around, affording very easy passage-ways to electricity, across the earth's magnetic field or system of lines of magnetic force, that fitting circuits can certainly be found (either passing through, or else entirely omitting the meteorite itself), in which, in the way suggested in the above letter, electric currents may be quite certainly concluded to be magneto-electrically induced. For while one part of a closed air-circuit resting against the meteorite's front surface, and another part of it situated in the still atmosphere in front of or behind it, would be journeying towards or from each other with full meteor-speed, the circuits so composed would be most suitably conditioned for developing induced currents round them by

[1] Although a very general belief, it is as yet an entirely mistaken supposition that the high speed of impact of a meteorite into the rarer regions of the atmosphere reduces the air, by giving it no time to dissipate itself in front of the meteorite, to a state of granulation, or to a wedged throng of molecules producing heat by friction *inter se* and against the surface of the meteorite. Just the reverse of this condition is, however, really true, that the air remains a perfectly and frictionlessly elastic fluid, however much it is compressed and intensely heated by the impact. The speeds of sound-waves in the heated air which perform the office of transmitting and maintaining the orderly array of pressures in the streaming flows, at length differ in defect, in fact, from the air's speeds themselves in proportions which, as those mount up to meteor-speeds of many miles per second, only decline asymptotically to about the ratio $1:\sqrt{5}$, or nearly $1:2\frac{1}{4}$. Since, then, these sound-waves, which convey the strokes and shocks of the collision to and fro between the meteor-centre and the surrounding air, arise and travel in the moving field of the compressed air as if it were at rest, it is easy to perceive that by their extremely rapid actions a most exceptionally perfect elastic-fluid relation, or steady disposition of the lines, or lanes of air-flow and blast-pressure, must really be established and maintained in evenly persistent shapes and contour, in the swirl of incandescent air which forms the meteor's head.

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their quickly altering enclosures of a constantly changing number of the earth's lines of magnetic force, while thus rapidly opening out or closing up. But the very short extent, not probably much exceeding some few feet or yards, which the swiftest moving part of such a circuit, in meteor-nuclei of various sizes, would embrace, and again the oft-proved weakness of the earth's magnetic field for exciting such induced electric currents, scarcely allow us to expect that any very high voltages would be attained in even the most select cases and the most favourable choices of conditions of such meteoritically produced air-circuits. The hottest, and therefore also probably the best conducting portion of each current's path, compressed against the meteorite's front surface, would also not, presumably, be that in which the heat and light producing action of the current would be strongest, since this would rather be used up in producing brush and glow discharges through the more resisting portion of the circuit in the outer air. The interior parts themselves of stony meteorites, when they have fallen, have not been found, by either sight or touch, to furnish any proofs of having been much heated, but intense effects of heat and fusion on the outer surfaces of fallen meteorites are always very obvious.

While nothing seems to point to any very easily discernible actions of electric currents immediately around a meteor's head, unless we may ascribe to electric agency the occasional production of an "aura" of sparks, or of a misty envelope of light enshrouding it, the stream of heated dust and vapours which travel in a meteor's wake, extending to considerable widths and lengths, as may be often noted, is perhaps a more visibly displayed, and a more evidently and distinctly active scene of luminous discharges of induced electric currents: for the accumulated flow behind the meteor-head resembles in some degree a columnar, vaporous follower of the meteorite itself, left to pursue its course along the meteor-track when the nucleus has disappeared. Being thus virtually a shooting-star of a long-extended shape, but of too dwarfed velocity to raise itself by heat to incandescence, the same induced electric currents as were above inferred to be developed in the meteor's head would here continue to evince themselves along the column by glow discharges in the vapours and the outer air, so long as sufficiently swift flow of the vapours can be persistently maintained through the retarding resistances of the opposing atmosphere. Thus a fairly intelligible *raison d'être* by electric current interventions may not impossibly have been incidentally divulged, by means of the recourse proposed by Mr. Brown to magneto-electric actions, of the long-enduring light-streaks left along the paths of all the swifter class of shooting-stars and larger meteors; the real *modus operandi* of those streaks having always presented to meteor observers a mysterious question for discussion, never admitting hitherto of satisfactory solution by known experimental illustrations, or of any quite surely sound elucidation by less trustworthy conjectures.

A. S. H.

A R re Game Bird.

I THINK it is worth recording that on Thursday, October 5, Sub-Lieut. H. R. Sawbridge, R.N., shot a quail, *Perdix coturnix*, on Lopham Fen, close to the rising of the waters, the common source of the Waveney and the Ouse, near Diss, Norfolk.

The bird, either a hen or a young male, was very fat—a beautiful little specimen.

The last quail known (by me) to have been shot in this neighbourhood was in the 'fifties of the last century, by Mr. Henry Button, of this parish.

I understand that this bird was much more frequently found in the middle of last century in the neighbourhood of Great Yarmouth, and that, as a rule, it was found singly, as this was, in the autumn.

It is being preserved by Mr. Cole, of Norwich. What was a little foreign bird like this doing singly and alone on our eastern counties' heaths and fens?

Is it a case of lost or strayed, or what is it?

It would be interesting to know whether other specimens of the quail have been heard of inland in the eastern counties of late years.

JOHN S. SAWBRIDGE.

Thelnetham Rectory, Diss, Norfolk, October 16.

PHYSICAL LABORATORIES IN GERMANY.[1]

THE Director-General of Education in India has just published a valuable work in a report by Prof. Küchler, of the Presidency College, Calcutta, on physical laboratories in Germany. It forms one of a number to be included in a volume of the series of occasional reports.

Prof. Küchler "was placed on special duty to inquire into (1) the methods adopted at the universities and polytechnics of Berlin, Munich, Vienna, and other prominent universities and technical institutions in Germany with regard both to the ordinary study of physical science and to the character of the investigations and the system pursued in the case of students who are entering upon a course of independent research. (2) The construction and equipment of modern German laboratories, the special merits of scientific instruments of German manufacture, and the facilities for standardising these instruments which are offered at central institutions in Germany."

In the course of his tour, lasting more than six weeks, the principal universities and technical schools were visited, and the report sums up the information in a useful manner. It is naturally divided into two sections corresponding to the two parts of the reference; the first deals with the methods of study, the second treats of the construction, methods of equipment, &c., of the laboratories. The training of the university undergraduate of necessity differs from that of the pupil of the high school, and both methods are described at some length. Attention is directed to the importance of the set lecture in the scheme of education; the number of lectures given during the session in a university such as Berlin is very considerable, and each lecturer has the use of a properly equipped lecture-room and apparatus. The importance of the organised teaching of practical physics, for medical students, chemists, and engineers, in addition to the professed physicist, is now realised in Germany, and in an appendix, which, however, is not printed in the report, details of the practical instruction at some of the universities and technical colleges are given. In view of the large number of students in some of the German universities, the numbers attending practical classes, as given on p. 7, seem small. At Berlin there are 140 students in two divisions, each under three assistants. The average number of students in the charge of a single assistant comes to twenty-two or twenty-three, which is probably about the same as in one of our well organised English courses.

Students who propose to take a degree in physics work usually for two years at a dissertation. Prof. Küchler specially directs attention to the fact "that students are discouraged from commencing the final stages of their labours before they have been thoroughly trained in practical manipulation and have carefully gone through a complete course of laboratory work such as is represented, say, by Kohlrausch's very elaborate handbook." This fact is sometimes conveniently forgotten by those who urge the adoption of the introduction of research work at an earlier stage in our English training; the average number of these research students is said to be five or six, though, of course, at Berlin, as indeed at Cambridge, the number is much larger.

To illustrate the construction and equipment of the laboratories, Prof. Küchler has given in full the plans of a number of representative institutions, and these plans form a most valuable part of the report. They will enable a professor building or organising a

[1] A Report to the Director-General of Education in India by Prof. G W. Küchler.

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